~~D. Croxton~~
WAD 2917
AFA 8b
10-15-93

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

Reply to
Attn. of: HW-106

OCT 15 1993

FILE COPY

John Stiller
Project Coordinator
Burlington Environmental Inc.
Waterfront Place One
Suite 700
1011 Western Avenue
Seattle, Washington 98104

Re: BEI Pier 91, EPA I.D. No. WAD 00081 2917
Pier 91 RCRA Facility Investigation

Dear Mr. Stiller:

Included in the enclosure are Environmental Protection Agency (EPA) comments regarding outstanding issues of the Resource Conservation and Recovery Act (RCRA) Facility Investigation at the Burlington Environmental Inc. (BEI) Pier 91 facility. As discussed by phone, a meeting to resolve these and other issues is scheduled for 10:00-12:00 a.m. November 3, 1993 at EPA. If possible, I would like to discuss these comments with you prior to November 3, 1993. Continued communication will make the meeting more productive and may allow us to settle some issues prior to it.

See you on November 3, 1993.

Sincerely,

David Croxton

David Croxton
RCRA Permits

Enclosure

cc: D. Hotchkiss, Port of Seattle
G. Tritt, Ecology-NWRO
C. Wang, Ecology-NWRO

EPA COMMENTS ON OUTSTANDING
PIER 91 RFI ISSUES

1) PUMP TEST

a) Section 3.4, Tide Level: The workplan states that tidal measurements used to adjust the pump test will be sourced from a station five miles away and will be recorded every hour. While it may be that this station provides an accurate representation of the tidal elevations and tidal cycle timing at Pier 91, BEI has not presented any data to demonstrate that is the case. Such factors as the configuration of the local shoreline and bottom, wind direction, wind strength, and wind duration are important in determining local tidal conditions. Before the tidal data from five miles away should be used in the correction of the data from the pump test, BEI must demonstrate that both sites have compatible tidal cycles and timing at a scale that will not significantly affect the results. One means to accomplish this demonstration would be to compare NOS data with transducer data obtained from Elliot Bay near the facility. Without such information the validity of the data corrections will be in doubt.

In addition, hourly measurements of tide levels may be too infrequent. BEI and EPA agreed earlier that 1/2 hour intervals for analyzing tidal effects was more prevalent in the literature. Unless BEI presents evidence to the contrary, tide level data should be provided on at least 1/2 hour intervals.

b) Section 4.3: BEI needs to provide more details regarding the particular analytical method used to analyze the pump test data, since the use of an inappropriate analytical method can give misleading results. BEI should provide a justification of the selection of the particular analytical method based on BEI's construct of the expected hydrogeological conditions at the facility during the pump test (e.g., confined or unconfined, leakage expected, partial penetration, whether Kv/Kh ration has to be considered within the aquifer, etc.).

In addition, the conceptual model can be used to check the design and response of the pump test. By preparing expected drawdown curves based on the conceptual model, these curves can be compared to the actual results as the test is in progress and corrections in the duration and frequency of measurements can be made during the test.

2) SUBSTITUTION OF WELL 39-3

The information presented in your September 24, 1993 submittal indicates that the contamination in 39-3 is currently

indistinguishable from floating product on-site and that BEI wishes to postpone the installation of well CP-120 until the development of an integrated off-site RFI workplan. EPA believes the floating product needs to be addressed on an accelerated schedule and that stabilization actions are appropriate and beneficial. Please be prepared to discuss your plans and schedule for addressing LNAPL contamination.

3) MONITORING WELL W-10

On October 5, 1993, BEI provided follow-up information on the variance request for well W-10 as requested by EPA. EPA will review this material and provide a response to BEI. In the meantime, it is understood that BEI continues to monitor and sample this well.

4) TIDAL MONITORING TEST

BEI's justification for not needing to perform a second tidal monitoring test has largely been provided orally; a technical defense of BEI's position is not in the record. Also, BEI has not presented any of the results from their initial tidal monitoring test.

It remains EPA's opinion that more than one tidal monitoring study is necessary to understand the variable impacts of tidal effects on the lower aquifer. Below, I have summarized some information that Bob Farrell, PRC contractor, put together to support EPA's original position for performing more than one tidal monitoring test.

The results presented are from a tidal test at Occidental Chemical Corporation in Tacoma, Washington. The data indicate that tidal impacts on aquifer systems are complicated and can not be easily deduced from one measurement event. The data show significant short term variations in hydrographs of water level data that make the accurate prediction of water elevations difficult. The degree of this variation in tidal impacts needs to be investigated to determine whether the variation is significant or not to the calculation of average water elevations. Without the measurement of several complete tidal cycles at each well and in the waterway, and an understanding of the amount of variation in tidal effects, there is little confidence in the accuracy of calculated average water elevations.

The attached hydrograph (Figure 3.14) shows two tidal peaks and troughs. The time (t) between the two peaks is 810 minutes and the time between the two troughs is 700 minutes. The lag times expressed at the wells are not constant. For well EW-133-50, lag times range from 38 to 50 minutes, for well 26-25 they range from 30 to 40 minutes, and for well 26-50 from 15 to 20

minutes. Similarly, the tidal efficiencies (TE) also vary. For well EW-133-50, TE ranges from .49 to .56, for well 26-25 from .49 to .56, and for well 26-50 the TE ranges from .48 to .5. The degree of variation in these parameters is unknown at Pier 91.

From Figure 3.14 the actual average water elevation at each well for cycles 1 & 2 can be determined and a comparison made of the actual water elevations for the second cycle with a calculated water elevation for the second cycle. To determine the predicted change in head the TE was multiplied times the change in the average head of the waterway between the cycles (.65 feet). This change was added to the previous average water level at each well from cycle 1 to determine the predicted water elevation in cycle 2.

	average elevation -- cycle 1	- cycle 2--	-- TE--	predicted change in head	--predicted --elevation
EW-133-50	0.05'	.25'	.56	.36'	.41'
WELL 26-25	1.25'	1.45'	.56	.36'	1.61'
WELL 26-50	2.1'	2.35'	.50	.32'	2.42'
WATERWAY	-.25'	.40			

The differences between the actual water elevation at each well in cycle 2 and the predicted elevations are introduced because of differences in the length of the two tidal cycles, changes in the elevation of each tidal cycle, changes in lag times, and possible barometric pressure changes.

These data ultimately result in widely varying results for such parameters as the ratio of transmissivity to storage. Using the following equation, data ranges for this ratio ranged considerably:

$$T/S = \frac{(x^2)t}{4(Pi)(to^2)}$$

; where x=distance to shoreline
; t=period between peaks or troughs
to=lag time between maximum or minimum of the ground water cycle and the same maximum or minimum in the tidal cycle.

For well EW-133-50 the T/S ratio varied from 92 to 138 feet sq./min, for 26-25 the ratio varied from 87 to 179 ft. sq./min., and for 26-50 the ratio was 391 to 804 ft. sq./min. The T/S ratio is useful in demonstrating that the aquifer has significantly different characteristics in only a few feet (10 to 15 feet in this case).

Further evidence of natural variation in tidal efficiencies is evident during a pump test at this same site. Well 26-50 was used as an observation well during a 72 hour pump test that covered 4 tidal cycles. No response occurred during the pump

test that was attributable to the pumping. During the test the TE of well 26-50 ranged from .43 to .66 (compared to .48 and .50 earlier).

The hydrograph of the average heads of well 26-50 in the well still indicate influence of the tides which are not consistent from one cycle to another. To demonstrate this inconsistency, the average heads in the well were adjusted to account for the range in the average waterway elevation from a datum of 0 feet elevation using the TE that was determined. The resulting curve (see figure) shows the residual change in water elevation in well 26-50 through the monitoring period. The time between peaks varies significantly between the different figures and during each monitoring period. On figure 3.14 the time between peaks is 810 minutes, while on the second figure, the time between peaks varies from 580 minutes to 895 minutes.

In conclusion, experience has shown that there are significant short term variations in the hydrographs that make the prediction of the water elevations difficult in the short term and that monitoring more than one cycle is necessary in order to be able to predict the average ground water elevation occurring at a well. Only by examining these differences between the tidal cycles relative to the ground water gradients, can we confidently estimate average ground water flow.

END

Pumping Test EW133-50

Monitoring Well 26-50

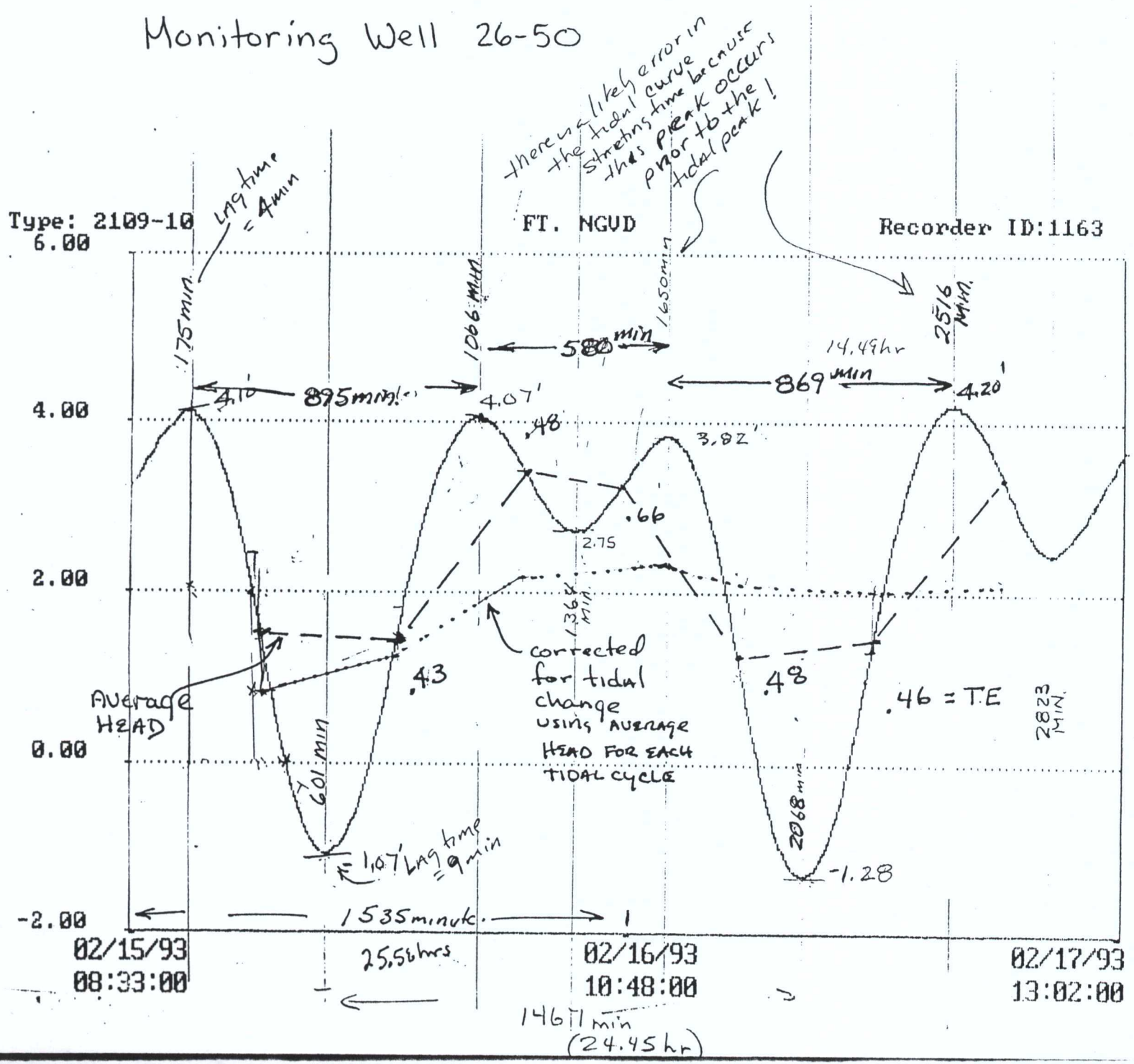
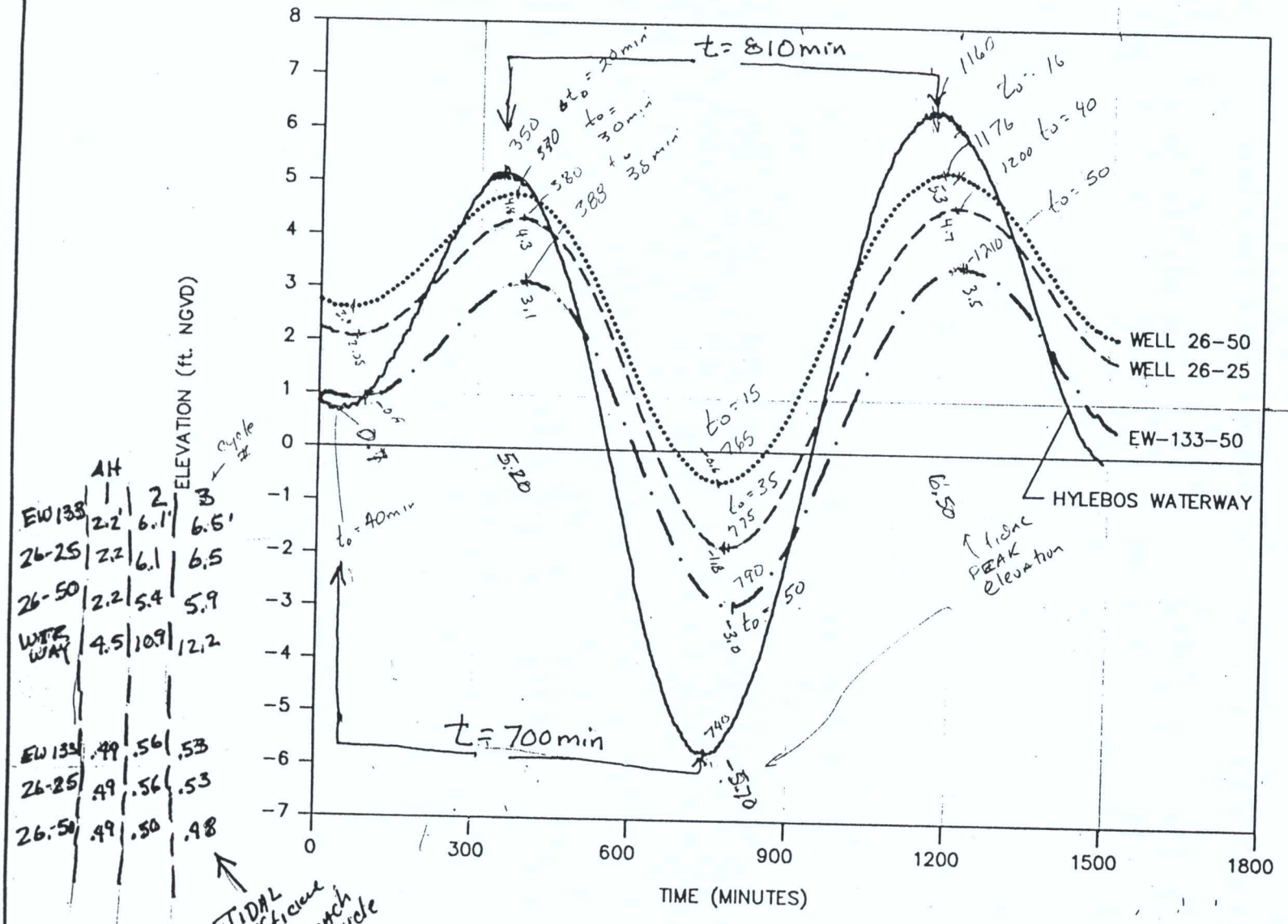


FIGURE 1



	ΔH 1	2	3
EW133	2.2'	6.1'	6.6'
26-25	2.2	6.1	6.5
26-50	2.2	5.4	5.9
WATERWAY	4.5	10.9	12.2
EW133	.49	.56	.53
26-25	.49	.56	.53
26-50	.49	.50	.48

Distance from Shoreline (x)
EW 133 = 60'
26-25 = 50'
26-50 = 53'

Cycle #	1 (peak)	2 (bottom)	3 (peak)
EW133-50	38	50	50
26-25	30	35	40
26-50	20	15	16

Lag times (minutes) (to)

$$T = \frac{x^2 S t}{4\pi t_o^2}$$

t = 810 min = 13.5 hr
t = 700 min = 11.66 hr

figure 3.14

STATIC GROUNDWATER ELEVATIONS VS. TIME
WELL 26-25 AND 26-50 WITH WATERWAY
EW-133-50 PRELIMINARY PUMPING TEST
Occidental Chemical Corporation—Taconma, Washington

CRA

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